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Original article

Task Analysis in Human-Computer Interaction: A Comparison between Four Task Analysis Techniques

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ABSTRACT

Task analysis is an integral part of human-computer interaction, as it permits the client to comprehend, complete, and benefit from the utilization of an interaction system. Task analysis methodologies differ based on the selected approach and the motivation behind its use. The present study aims to compare several task analysis methodologies (i.e. hierarchical task analysis, cognitive task analysis, GOMS task analysis, and emotion task analysis), initially outlining their commonalities and distinctions in structure and usability. After that, it will go into each technique's benefits and drawbacks and how well-suited it is for different jobs. The main results that have been obtained by this research are: the HTA technique is an appropriate selection when the analysis seeks to explore the connections and interdependencies among different components of the task, whereas CTA is appropriate for the analysis that necessitates a technique with an undefined structure comprising of interviews. If the analysis system seeks to identify a cognitive process with a clearly defined structure, the GOMs technique can be a superb option. Lastly, when the task analysis aims to comprehend the emotional aspects of task performance, the ETA serves as an effective instrument to employ. In terms of usability, HTA is widely utilized in the fields of task assistance design and error prediction. CTA proves to be beneficial for tasks that demand sophisticated cognitive functions, GOMS is typically employed in the creation of training tools, the design of assist frameworks, and the documentation for clients, and ETA examines how users' psychological or emotional states influence their responses to tasks as they complete them. It is advised that readers go over this comparison paper in order to obtain a better knowledge of how to select the precise strategy that can aid in finishing an assignment.

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INTRODUCTION

Human-Computer Interaction (HCI) relies heavily on graphical user interfaces that are designed to provide user-friendly and efficient experiences. One crucial aspect of HCI is Task Analysis (TA), which provides us with a window into understanding the nature of user interaction.

Task analysis is the process of breaking down complex tasks into smaller, more manageable components. It helps designers and researchers better understand user requirements, cognitive processes, and work practices. By analysing tasks, HCI professionals can identify potential usability issues, design more intuitive interfaces, and improve user experience. Because of this, several task analysis techniques have been developed to identify and analyse the essential components of a given task [1].

Over the years, numerous research studies have been conducted to compare different techniques for task analysis. One such study was published in 1995 by S. Sebillotte, which offers a comprehensive overview of the task analysis methodology. This article provides valuable guidance on effectively conducting task analysis and outlines the main steps involved in the process. Moreover, it discusses various methods of task analysis, including cognitive, conceptual, and physical approaches, highlighting their respective advantages. Furthermore, the article emphasizes the significance of considering the user's mental models and the impact of task complexity on interface design [2].

Another study, conducted in 2011 by T. Astiasuinzarra Bereciartua, explores the utility of hierarchical task analysis, cognitive work analysis, and GOMS task analysis. This paper presents a detailed analysis of the distinctions between these three methods and how each one can be employed to analyse the cognitive aspects of a specific task [3].

However, it is important to note that task analysis plays a significant role in problem-solving in diverse fields, such as artificial intelligence and educational pedagogy. To effectively address specific issues, there are four widely used methods for conducting task analysis: hierarchical task analysis, cognitive task analysis, GOMS, and emotion task analysis. Each of these approaches offers unique advantages. For instance, hierarchical task analysis helps in understanding the internal structure of a task, while cognitive techniques and emotion task analysis involve conducting in-depth interviews to gain insights into how users apply their expertise [4].

The purpose of this study is to compare these different approaches of task analysis, which will provide valuable contributions as listed below:

- *Utilizing hypothetical illustrations to show how the targeted task analysis methodologies differ regarding structure and usability*
- *Enhancing decision-making by providing better insights into the selection and application of each strategy.*

In addition, the present study has identified two research inquiries to facilitate the comparative investigation which are: Research Question 1: In what ways do the various task analysis techniques (namely, HTA, CTA, GOMs, and ETA) differ in terms of their structure and usability? Research Question 2: What are the key advantages and drawbacks of the chosen techniques (HTA, CTA, GOMs, and ETA) as evidenced by the recent study?

Task analysis is the process of thoroughly understanding the activities that the user needs to perform to design a computer system that effectively supports them. The term "task" refers to the user's job or other activities related to their work, or simply what they are trying to accomplish. Analysis is a systematic approach to understanding the user's work that goes beyond unsupported assumptions or guesses to accurately document and define the specific requirements of the task. Task analysis is particularly valuable in the field of human-computer interaction. To complete the Task analysis stage, certain techniques are necessary.

In terms of efficiency and effectiveness, a study conducted in 2004 examined hierarchical task analysis, cognitive task analysis, and GOMS. Efficiency encompasses complexity and usability, while effectiveness encompasses output quality, depth, and breadth. Prioritizing efficiency, hierarchical task analysis breaks down complex tasks into smaller ones, requiring substantial development and charting of hierarchies for complex activities. GOMS, on the other hand, involves a detailed investigation of keystroke-level interaction. While, cognitive task analysis establishes a consistent representation of knowledge in the research domain, requiring deep engagement with a specific knowledge topic. The results regarding effectiveness indicate that hierarchical task analysis can enhance problem identification and is suitable for concurrent processes. However, it does not consider system dynamics. While GOMS improves productivity, it does not apply to larger issues, neglects contextual considerations, and ignores cognitive task analysis. It enhances understanding of cognitive aspects but does not fully incorporate learning, contextual, historical, and sociological variables [5].

Furthermore, a study was undertaken in 2010 to compare hierarchical task analysis and cognitive task analysis in terms of their theoretical, methodological, and practical aspects. The findings from a theoretical standpoint revealed that the hierarchical task analysis is primarily concerned with achieving system goals and can be categorized as both descriptive and normative, as it outlines the actual or ideal methods of goal attainment [5]. In terms of methodology, the hierarchical task analysis follows a well-established, step-by-step approach. However, when it comes to practical applications, the hierarchical task analysis only guides what should be done and how it should be done, without considering unexpected scenarios [6].

In 2020, a scholarly publication presented findings that classified hierarchical task analysis as a method for semantic analysis, while highlighting the distinction between hierarchical task analysis and GOMS. It was observed that GOMS relies on user predictions, rendering it more intricate and demanding specialized expertise for analysis. This suggests that hierarchical task analysis is relatively simpler to employ in comparison [7].

In regards to the analysis of emotions and cognitive tasks, a study published in 2020 discussed how cognitive techniques are presented as cognitive elements to understand how individuals employ cognitive strategies while performing tasks. The primary method of data collection involves conducting in-depth interviews with experts in the subject matter. Additionally, an analysis of the emotional aspect of task analysis explores how emotions like frustration or nervousness can contribute to errors during task execution. It is worth noting that a cognitive task analysis can effectively describe a mentally challenging task, but it may not explain it. Simply describing the task may overlook the underlying mechanisms that could lead to increased mental workload and decreased performance [8].

Task analysis techniques

Understanding user requirements, interaction models, and important features all depend on task analysis. Thus, choosing the appropriate strategy is crucial to guaranteeing the task analysis process's effectiveness. This section seeks to provide practitioners with guidance and insights by providing a thorough explanation of each selected method.

Hierarchical task analysis

Hierarchical Task Analysis (HTA) is widely recognized as a valuable and practical approach used to understand and assess complex systems and tasks. This technique provides a detailed breakdown of the different steps involved in completing a task or achieving a particular goal. HTA is extensively applied in fields such as human factors engineering and user-centered design, allowing for the identification of potential obstacles and the improvement of system usability and effectiveness. Breaking down the task into smaller subtasks is an essential step in this technique. This makes it more systematic and easier to handle each component [3].

By establishing a hierarchical arrangement, as illustrated in Figure 1, the organization and flow of the task become clearer. Through a detailed analysis of each subtask, one can gain insights into the specific actions, decisions, and interactions necessary for its completion. This hierarchical structure further assists in recognizing how different levels of the task are interconnected and dependent on each other. HTA usually consists of three primary components [3]:

- Goals: These are the main things that must be accomplished.
- Plans: These are the high-level strategies or approaches to achieving the goals.
- Subtasks: These are the particular acts or procedures needed to carry out each plan.

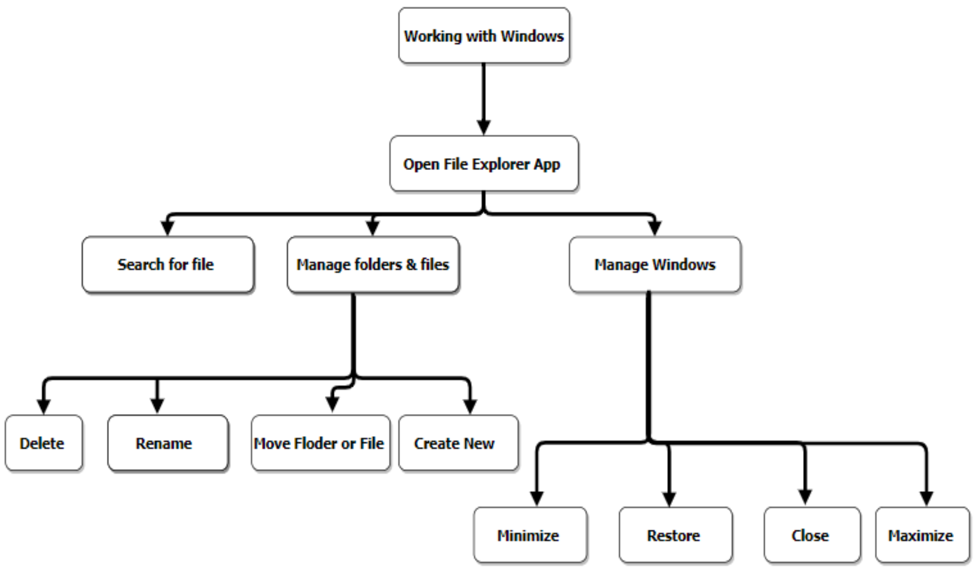


Figure 1. Windows-based Hierarchical task analysis diagram.

By using diagrams or charts, HTA provides a visual representation of how different goals and plans are interconnected, enabling a comprehensive understanding of the task's complexity. The hierarchical framework allows for a systematic breakdown of the task into manageable subtasks, ensuring efficient planning and execution. The implementation of this analysis method is valuable in identifying possible bottlenecks, areas for improvement, and potential risks or mistakes in the sequence of tasks. HTA can be conducted through different means, including task observation, conducting interviews, or reviewing documentation. The gathered information is then organized and analysed to create a hierarchical structure of the tasks. In essence, the utilization of HTA offers a systematic and structured approach to comprehending and analysing complex tasks and systems. It aids in recognizing areas that can be enhanced, improving user experience and effectiveness, and minimizing errors or risks associated with task execution [5].

Cognitive task analysis

Cognitive Task Analysis (CTA) has emerged as a new set of research methods that delve into the examination of cognitive processes. The main focus of CTA is to understand the fundamental conceptual framework, cognitive operations, and knowledge that are crucial for successfully carrying out tasks [9].

The development of CTA was driven by the realization that traditional approaches to breaking down tasks were inadequate in dealing with the increasing complexity, knowledge-intensive nature, and integration of technological support in tasks. Therefore, CTA is a vital component of task analysis as it aims to understand tasks that require a high level of cognitive engagement from users, particularly activities that involve decision-making and problem-solving [10]. Typically, most CTA approaches can be categorized into five distinct phases as shown in Figure 2, which are [11]:

- Gathering preliminary knowledge.
- Determining knowledge representation.
- Applying focused knowledge elicitation methodologies.
- Analysing and validating the collected data.
- Preparing the results for the intended application.

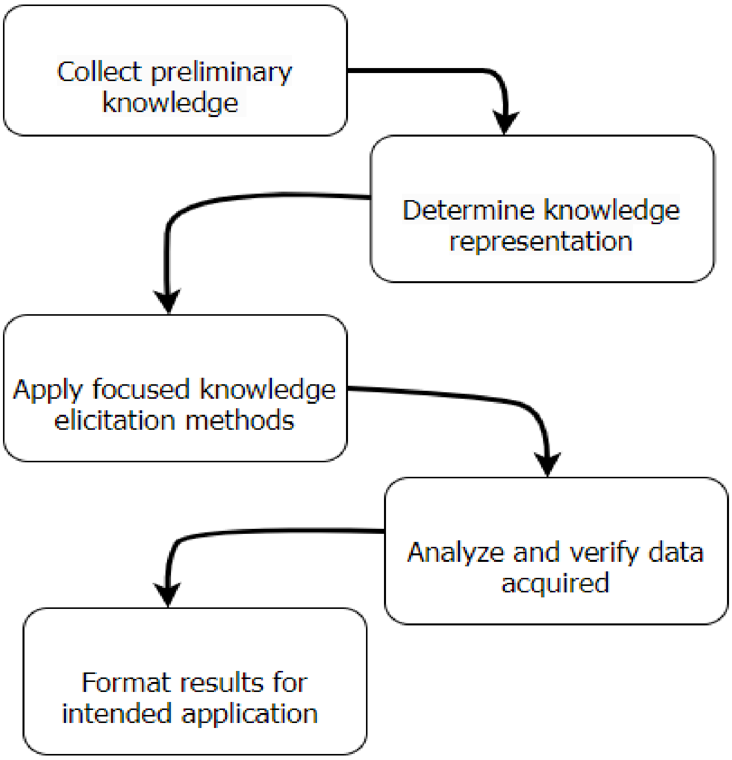


Figure 2. CTA structure

The emphasis of CTA lies in comprehending how users think and learn, as well as identifying any barriers they may encounter. In addition, it takes into consideration the design elements that can influence the likelihood of users making errors. CTA is no longer viewed as a mere requirement to modify operators' knowledge; rather, it is recognized as an integral part of task design that aims to enhance the usability and effectiveness of the device or task. Cognitive task analysis has been utilized to compare the performance of professionals and non-professionals. The goal of this analysis is to aid expert users in their decision-making tasks and to study the mental fatigue that can arise from complex controls and displays. Moreover, CTA can be used to assess the development and evolution of mental models and to investigate troubleshooting, problem isolation, and diagnostic procedures. When designing a final product for expert users, it is crucial to consider response time as a significant factor [10].

GOMS task analysis

GOMS Task Analysis is a cognitive technique of human-computer interaction, it is for modelling human information processing [7], the analysis of this technique has been widely acknowledged as a significant theoretical concept in human-computer interaction ever since the publication of "The Psychology of Human-Computer Interaction" by Card et al. in 1983 [12]. This notion proposes that evaluating the understanding of task execution in terms of Goals, Operators, Methods, and Selection (GOMS) rules is advantageous as shown in Figure 3. As a result, numerous studies have been conducted to validate and build upon the initial work [13]. The structure of GOMS is as follows:

- Goals: What does the user want to do?
- Operators: Specific steps that users can take and assign a specific execution time.
- Methods: Well-learned sub goals and operator sequences can accomplish a goal.
- Selection Rules: Guidelines for deciding between multiple methods.

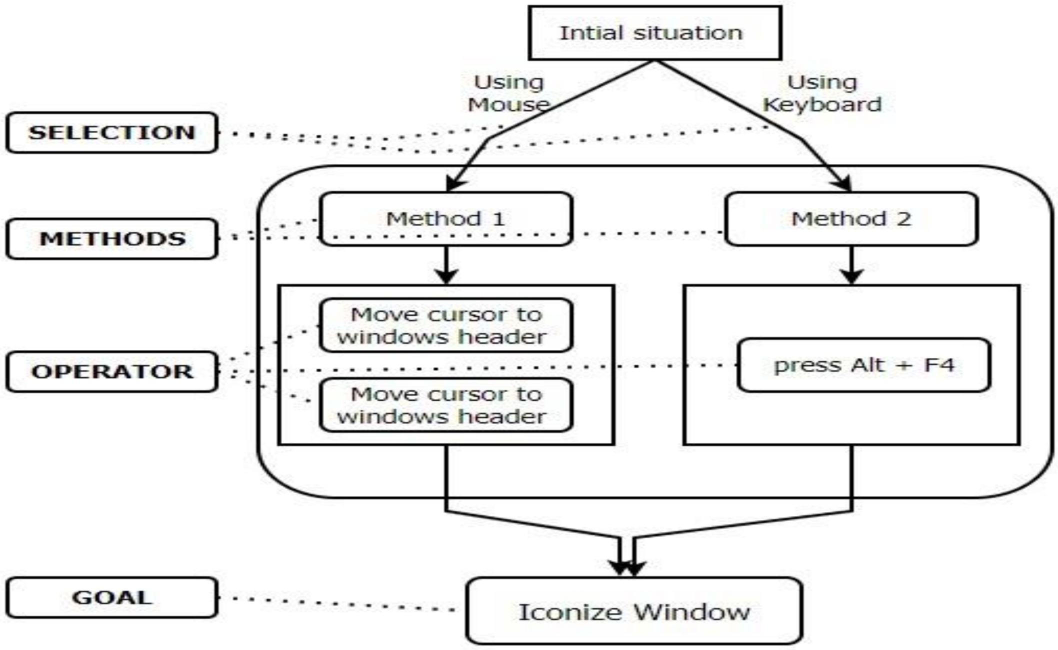


Figure 3 GOMS task analysis for closing windows

GOMS framework analysis can be carried out at two distinct levels: the algorithmic level and the implementation level. This is a result of GOMS's emphasis on the value of using technology and a variety of methods to complete tasks. The framework primarily concentrates on the organization, strategies, and sequencing of tasks necessary to accomplish goals efficiently and effectively.

According to David Kieras, a GOMS model is a portrayal of the step-by-step understanding that a user needs to carry out actions on a device or system. It is a useful tool that provides guidance on how to accomplish tasks both within and across systems and helps with the creation of user documentation [14,15]. The GOMS technique provides valuable insights into the efficiency of a system by evaluating interface design and estimating the time required for each task system [16]. Furthermore, it examines the system's procedural characteristics [17], and anticipates human performance

[12,17,18]. It can be used to offer further information about the sub-goals of a task indicated in an HTA [19]. Moreover, it can reduce much of the empirical user testing required to create a system design [14]. In addition, the GOMS can predict outcomes in advance, which is quite valuable in the early stages of system design [3].

Emotion task analysis

To enhance computer application system interfaces, designers must consider the psychological and emotional aspects of users. Meeting the changing preferences and expectations of users requires a shift in perspective, focusing not only on functionality but also on addressing these needs. As a result, designers are recognizing the importance of integrating emotional elements into interface design. This approach allows for a more relatable and captivating user experience [8]. Consequently, the Emotion Task Analysis (ETA) has garnered considerable attention in the HCI community, including both researchers and practitioners. This interest arises from the necessity to create software systems that are sensitive to emotions, as well as conventional applications that prioritize understanding the user's psychological state. Emotions are now recognized as a vital component of the user experience, aiming to transition from purely functional and usable software to systems that hold inherent value for the user's emotional well-being.

Furthermore, the arrangement of emotional task analysis is a systematic approach that aims to comprehend the elements of an emotion-related task as shown in Figure 4 [8]. It entails dissecting the task into its constituent elements, dissecting those elements, and combining the findings to create a thorough grasp of the task. Additionally, certain applications that successfully tap into the user's emotions, evoking positive feelings such as excitement or passion, are especially valuable to users [20][21].

The examination of emotions in task analysis can be conducted from two perspectives: the algorithmic level and the implementation level. This examination arises from the emphasis on technology and the methodology used to accomplish tasks. It involves considering various strategies and processes to enhance user performance, ultimately leading to the more effective achievement of tasks and the improved attainment of goals [8].

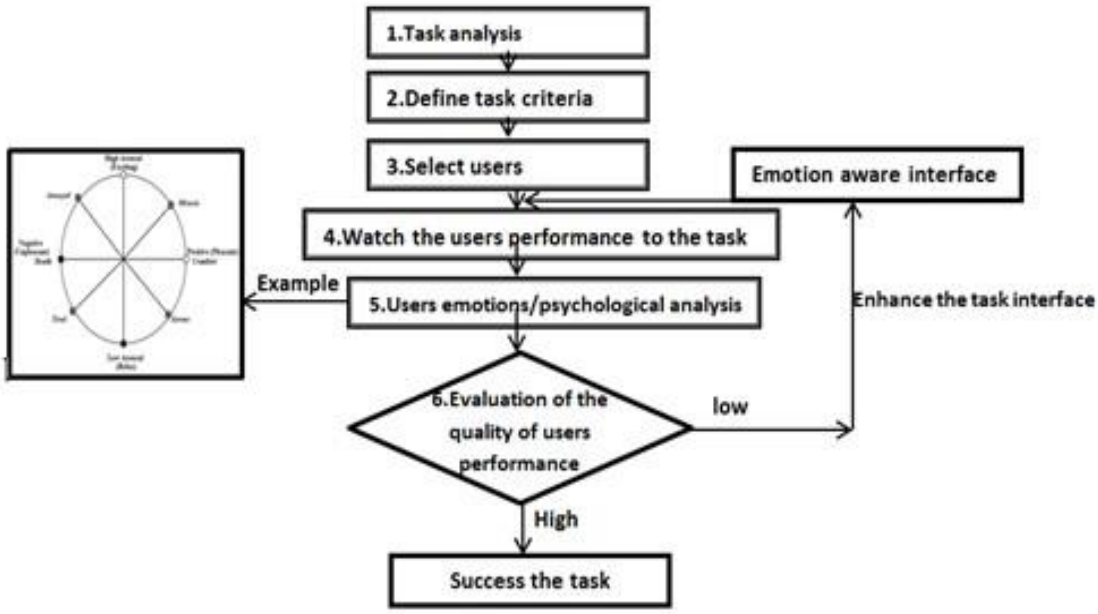


Figure 4. ETA structure

Comparison between four task analysis techniques

To compare four distinct task analysis methodologies, certain research questions were identified as stated in Section 1. This study attempted to address these research questions by outlining the following aspects: Structure of the technique, usability, advantages, and disadvantages.

Structure of the techniques

Each technique has its structure. Starting with hierarchical task analysis, it is a top-down approach that breaks down a task into subtasks and further into smaller steps. It provides a hierarchical structure that helps in understanding the relationships between different components of a task [3]. While cognitive task analysis looks at mental processes which

include cognitive skills and abilities that are necessary for the successful completion of each task. The CTA is an effective technique for enhancing the design of systems that interact with users (operators), as it helps to understand the thoughts and actions of users during task completion. The term "CTA" refers to a set of five phases that are intended to describe activities that require a high level of cognitive engagement from users. The first phase is knowledge gathering, followed by the representation of that knowledge, after that applying focused knowledge elicitation approaches which lead to data analysis and validating, and the final stage is setting up results for their intended application [11].

However, the GOMS technique divides the cognitive structure into four components: a set of Goals, a set of Operators, a collection of Methods for attaining the Goals, and a set of Selection criteria for selecting between competing methods. Finally, the structure of emotion task analysis is a systematic approach that seeks to understand the components of an emotion-related task. It involves breaking down the task into its parts, analyzing the components, and then synthesizing the results into a comprehensive understanding of the task [22].

Table 1. Show techniques' structure

Technique's Name	Structure type
HTA	Top-down approach
CTA	Set of five phases
GOMS	Set of four components
ETA	Systematic approach

Usability

In terms of usability, the HTA is used to examine each task required to accomplish a job, making it simple to analyse the relationship between tasks and the data required to perform them. HTA has persisted. It has been applied to a variety of tasks, including workload estimation, error prediction, job assistance design, and interface design and evaluation. Ergonomists are still coming up with innovative ways to employ HTA, ensuring its continued use for the foreseeable future [23].

In comparison, CTA is a knowledge-based technique that focuses on internal representation, language, knowledge structures, and perceptual cognitive filters [10]. CTA approaches are meant for usage by instructional designers and system designers rather than knowledge engineers, cognitive psychologists, and human factors/ergonomics specialists [24]. Researchers must have knowledge of cognitive psychology, domain knowledge, and interviewing skills when using CTA [14,19]. it is a way to determine the cognitive ability or mental requirements necessary to accomplish a task [24] for various levels of operators(users) ranging from novice to expert users [10], Therefore, CTA can be used to examine the performance difference between various expertise levels of users.

In addition, the focus of CTA has shifted from providing operator training to modelling knowledge applications and now modelling cognitive processes [10]. Therefore, CTA can acquire information about the performance of professional users on a certain task. As a matter of fact, CTA is placed at the algorithmic level of analysis, consequently, it focuses on how to gather information on the method and algorithm used to accomplish a task [8,22].

Compared to other techniques, GOMS is ideal for developing training tools and designing help systems as well as preparing user documentation. In fact, GOMS has the ability to implement the analysis at a very early stage of design, so it should be used to choose from various proposed systems. In addition, GOMS is favored for evaluating interface design, forecasting human performance, and studying the system's procedural features. Interestingly, GMOS provides additional information about sub-goals of tasks identified in an HTA.

To continue the process of comparison with an ETA, this is a novel addition in the sense that task performance is facilitated by state-based emotions [8,25]. Similar to how components are organized in a CTA, an emotional context may account for extra load/processes that could clarify a better understanding of task performance or potential error [26]. Moreover, the ETAs can be utilized to evaluate the usability of a framework or product design without degrading its curtness and practicality under one condition which is that ETA should be simple and streamlined, because it would involve having observers watch users complete a task and determine the valence and intensity of the users' emotions during the task. People's behaviors, particularly their facial expressions, can often be used by human observers to infer their emotions [8].

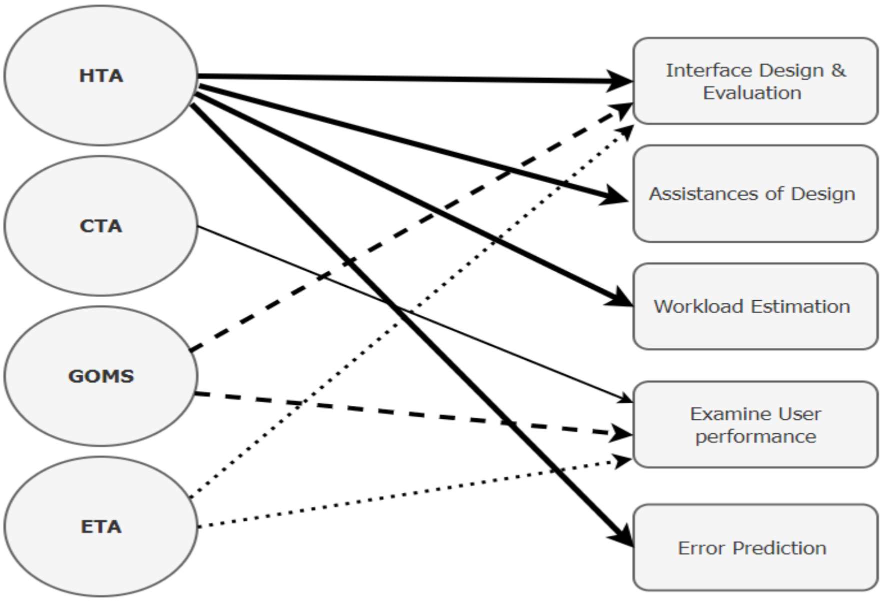


Figure 5 shows the types of tasks that can be these techniques applied to.

Advantages and disadvantages of task analysis techniques

In terms of the advantages and disadvantages, each technique has its benefits as indicated in Table 2. At the same time, some techniques can have the same disadvantages such as time issues each of HTA, CTA, and GOMS suffers with the time that is required to do the task. Another issue is that specific skill training is needed when using HTA or GOMS, while the main issue with using ETA is cultural differences that may result in difficulties in identifying emotions.

Table 2 shows the advantages and disadvantages of task analysis techniques

Technique's Name	Advantages	Disadvantages
HTA	• It is most economical in the sense that information gathering and organizing can be achieved to the point of desire. • An analyst can focus on the most important part of the task that has to do with safety. • Further error analysis techniques may begin with hierarchical task analysis. • Assists in allocating features to the system and human beings concerned. • The analyst is well aware of people's perceptions, and their plans and tasks [27].	• An excellent quantity of time is required because HTA is developed with several levels of human beings. • specific skill training as well as technical system knowledge are required for the analyst to efficiently break down the tasks [27].
CTA	• Offers detailed cognitive processes for expert task performance [19]. • Captures cognitive processes that may not be easily observable. • Gather extensive information in a short time.[5][19]. • CTA enables the separation of distinct mental processes conducted by system operators [9].	• It can be time-consuming and expensive [18]. • It can be difficult to collect accurate data about how people think and perform tasks. • The results of a CTA can be subjective and difficult to interpret. • CTA can be difficult to apply to complex tasks. • Understanding cognitive processes requires researcher expertise [19]. • Potential bias in interview and data collection [19].

GOMS	• Can be done at the initial design stage • It can help to identify potential problems with a task, such as errors or inefficiencies. • It can help to design training programs that are more effective and efficient. • It can help to improve the usability of products and systems. • Explores various task paths, enhances procedural knowledge for task completion and outcome achievement, designer aid in selecting by estimating performance and learning times [19].	• Complex requires professional analysis [5,7,18,19]. • Training required, time-consuming [19]. • Potential errors and mental workload during tasks are not taken into account. [19].
Emotion Task Analysis	• Goals could be made more achievable by trying to add interface features or offering help when specific tasks are affected by user emotions [8,20,21]. • Determining user preferences can be achieved through automated analysis of the user's emotional responses to interface elements. [28]. • Emotions enhance user performance on tasks. The presence of emotions can provide a deeper comprehension of task performance or potential errors. [25]. • The emotional experience with a software product or interface can significantly influence user engagement and interaction. For instance, it can influence the levels of interest, excitement, nervousness, and irritability experienced by users. [8,16].	• Users might have difficulty recalling their emotions with precision, particularly following an extended task • Divergent cultural backgrounds might pose challenges in recognizing emotions due to variations in emotional experiences, leading to distinct expressions of behavior [8].

RESULTS AND DISCUSSION

Several task analysis techniques have been applied in the area of human-computer interaction to offer diverse perspectives for comprehending and examining how individuals engage with tasks. Every technique has advantages of its own and focuses on different aspects of task completion. This study aims to answer significant questions for four task analysis methods regarding assisting researchers in choosing the appropriate technique. Referring back to the research questions mentioned in Section 1, the primary findings of this study can be summarized as follows:

As mentioned in research question 1 this research reached several results regarding the differences between these techniques in terms of structure and usability aspects.

Firstly, regarding the structure, task analysis techniques present a systematic approach for comprehending and breaking down challenging tasks into smaller components that are easier to handle. These methodologies provide a sequential framework for decomposing processes, understanding relationships, and identifying the underlying processes. The structures of task analysis techniques vary depending on the specific methodology employed in the research.

If the analysis aims to investigate the relationships and dependencies between different elements of the task, the HTA technique is an appropriate choice. It is a structured method that breaks down tasks into a hierarchical structure. HTA involves identifying the main goal or objective of the task and then decomposing it into sub-goals, sub-tasks, and individual steps [3,6,23].

If the analysis requires a technique with an undefined structure including interviews, observations, and cognitive modelling, a flexible technique such as CTA is suitable for this task. CTA is a broad approach that encompasses various techniques to understand cognitive processes [10,11].

If the analysis system aims to identify a cognitive process with a well-defined structure, the GOMs technique can be a great choice. GOMS is a specific technique within the CTA framework that follows a structured approach to task analysis by decomposing tasks into their constituent elements: Goals, Operators, Methods, and Selection rules [13,14]. This systematic deconstruction facilitates the examination of procedural elements and decision-making processes implicated in executing a task at a detailed and structured level [11,15].

If task analysis aims to understand the emotional aspects of task performance, the ETA is an effective tool to use. The Emotion-Task Analysis framework necessitates the recognition of emotions experienced by individuals during the execution of a task, followed by an investigation into how these affect their performance. The fundamental components of this framework include the identification of the task, documentation of emotional responses, and examination of the relationship between emotions and task performance in a more scholarly manner.

Secondly, concerning the usability aspect Hierarchical task analysis is a valuable tool for comprehending task sequences, investigating interdependencies among tasks, and examining task complexity. It offers a systematic approach to task analysis, making it particularly effective for creating and assessing user interfaces and workflow processes. Furthermore, it is extensively employed in the domains of task assistance design and error prediction.

Cognitive task analysis is helpful for tasks requiring sophisticated cognitive functions, like decision-making, problem-solving, and understanding user behaviour. The cognitive process understanding of CTA enables the development of interventions, training programs, and decision support systems to improve task performance.

GMOS is a suitable strategy for task examination that requires an in-depth understanding of the sub-tasks that are recognized in HTA. It is normally used in creating training tools, designing assist frameworks, and client documentation. Moreover, GOMS is normally applied in the framework pre-design stage to investigate the conceivable undertaking ways and estimate its performance. In addition, it can assist in distinguishing potential issues earlier, creating efficient preparation programs, and improving procedural expertise for task completion.

Emotion task analysis examines how users' psychological or emotional states affect how they respond to tasks while completing them. It aids in determining how emotions may affect motivation, task performance, and user satisfaction. Understanding the affective components of usability and user experience is possible with the help of ETA.

As for the results reached by this research to answer the second research question to compare these four techniques in terms of their strengths and limitations, they are as follows:

Hierarchical Task Analysis (HTA) is a structured method that offers a systematic approach to dissecting complex tasks, allowing for a thorough understanding of their hierarchical structure and interdependencies. By identifying potential obstacles and safety concerns, HTA aids in refining task workflows and procedures. However, it can be time-consuming and resource-intensive, relying heavily on the expertise of analysts and struggling to capture subjective elements like cognitive load.

On the other hand, Cognitive Task Analysis (CTA) focuses on understanding the cognitive processes involved in task execution, highlighting key components and barriers that impact performance. While valuable for developing training programs, CTA can be challenging due to its time-consuming nature and the subjectivity of results. Expertise in cognitive processes is crucial for effective application of CTA.

Also, compared with GOMS, it provides a structured approach to task analysis and design based on cognitive models. It aids in identifying the necessary steps and potential issues in task execution, making it a valuable tool for designing efficient training programs. However, GOMS is complex and requires expertise to understand the underlying cognitive processes, which can be time-consuming.

Finally, as for the comparison with Emotion Task Analysis delves into the emotional aspects impacting task performance. It sheds light on how emotions influence motivation and decision-making, leading to interventions for emotion regulation [8,26]. ETA is based on expanding user needs from functional needs to psychological needs, therefore to improve the design of computer application system interfaces, designers should focus on meeting the psychological and emotional needs of users, and to be more human, the emotional factor is increasingly appreciated by interface designers Despite its benefits, ETA faces challenges in accurately measuring emotions and capturing their dynamic nature and interaction with cognitive processes.

CONCLUSION

In conclusion, the four task analysis methods (HTA, CTA, GOMS, and ETA) each have their distinct structure, usability, advantages, and disadvantages. HTA offers a systematic and detailed approach to task analysis, which proves beneficial for complex tasks, although it may present implementation challenges. On the other hand, CTA provides a more flexible and user-centred approach, enabling a deeper understanding of user behaviour, but it lacks a systematic structure. GOMS takes a quantitative and predictive approach to task analysis, making it useful for assessing system performance, but it may oversimplify user behaviour. Emotion task analysis provides a unique perspective by considering the emotional and affective aspects of user experience; however, it may lack a clear methodology. Ultimately, the selection of a task analysis method should be based on the specific goals and requirements of the analysis. It is crucial to carefully consider each method's strengths and weaknesses when choosing. Researchers and practitioners

should also explore the integration of multiple task analysis methods to leverage their respective strengths and mitigate their weaknesses.

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تحليل المهام في التفاعل بين الإنسان والحاسوب: مقارنة بين أربع تقنيات لتحليل المهام

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المستخلص
تحليل المهمة هو جزء أساسي من تفاعل الإنسان مع الحاسوب، حيث يسمح للعميل بفهم، وإكمال، والاستفادة من استخدام نظام التفاعل. تختلف منهجيات تحليل المهمة بناءً على النهج المختار والدافع وراء استخدامها. تهدف الدراسة الحالية الي مقارنة عدة منهجيات لتحليل المهمة) مثل تحليل المهمة الهرميHTA وتحليل المهمة الذهني CTA وتحليل المهمة GOMSوتحليل المهمة العاطفي(ETA ، حيث يتم في البداية توضيح توجهاتها واختلافاتها في الهيكل والاستخدام. بعد ذلك ستتناول الدراسة فوائد وعيوب كل تقنية ومدي وملاءمتها لوظائف مختلفة. النتائج الرئيسية التي تم الحصول عليها من هذا البحث هي كالتالي: تقنية HTA تعتبر اختيار مناسب عندما يسعي التحليل لاستكشاف وجود الروابط من عدمها خلال عدة مكونات للمهمة، في حين CTA هو الاختيار الأفضل لتحليل هيكل غير محدد يتضمن اجراء مقابلات. إذا كان النظام يسعي الي تحليل مهمة ادراكية او ذهنية ذات بنية واضحة فان GOMS يمكن ان يكون التقنية الأكثر ملائمة. أخيرا عندما يكون هدف تحليل المهمة هو فهم الجوانب العاطفية والنفسية لإداء المهمة فان ETA يعد الأكثر فاعلية في مثل هذه الحالات. من حيث الاستخدام، تقنية HTA تستخدم على نطاق واسع في مجالات تصميم المهمة وتوقع الأخطاء. في حين تم اثبات نجاح تقنية CTA في انجاز المهام التي تتطلب وظائف ادراكية معقدة بينما تميزت تقنية GOMs بقدرتها على انشاء أدوات التدريب وتصميم أطُر المساعدة ووثائق العملاء. تقنية ETA تستخدم لدراسة حالة المستخدم النفسية والعاطفية عند استجابته للمهام وادائها. يُنصح القراء والبحاث بمراجعة ورقة المقارنة هذه للحصول على معرفة أفضل حول كيفية اختيار الاستراتيجية الدقيقة التي يمكن أن تساعد في اكمال المهمة.
الكلمات الدالة. HTA ، CTA، GOMS، ETA، تحليل المهام، الهيكل، سهولة الاستخدام.